

CLAIMS

1. An isolated polypeptide having glucanotransferase activity, selected from the group consisting of:

- (a) a polypeptide having an amino acid sequence which has at least 65% identity with the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2;
- (b) a polypeptide which is encoded by a nucleic acid sequence which hybridizes under low stringency conditions with
 - (i) a complementary strand of the nucleic acid sequence shown as nucleotides 1 to 1503 of SEQ ID NO:1, or
 - (ii) a subsequence of (i) of at least 100 nucleotides;
- (c) an allelic variant of (a) or (b);
- (d) a polypeptide encoded by the glucanotransferase encoding part of the DNA sequence cloned into a plasmid present in *Escherichia coli* DSM 13049, or a variant thereof having at least 65% identity to said polypeptide; and
- (e) a fragment of said polypeptide having glucanotransferase activity.

2. The polypeptide of claim 1, having an amino acid sequence which has at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% identity with the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2.

3. The polypeptide of claim 1, comprising the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2.

4. The polypeptide of claim 3, consisting of the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2.

5. The polypeptide of claim 1, wherein the polypeptide has at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% identity with the polypeptide encoded by the glucanotransferase encoding part of the DNA sequence cloned into a plasmid present in *Escherichia coli* DSM 13049.

6. The polypeptide of claim 1, which is encoded by a nucleic acid sequence which hybridizes under medium stringency conditions, preferably under high stringency conditions, with

- (i) a complementary strand of the nucleic acid sequence shown as nucleotides 1 to 1503 of SEQ ID NO:1, or
- (ii) a subsequence of (i) of at least 100 nucleotides;

7. The polypeptide of claim 1, wherein the polypeptide is a variant of the polypeptide having an amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2 comprising a substitution, deletion, and/or insertion of one or more amino acids.

8. The polypeptide of claim 1, which retains at least 75% activity after incubation at 67°C, preferably after incubation at 70°C, for 10 min in a 20 mM phosphate buffer, pH 7.0, the activity being measured relative to the activity of the polypeptide after incubation at 65°C for 10 min in a 20 mM phosphate buffer, pH 7.0.

9. The polypeptide of claim 8, which retains at least 80%, such as at least 85%, preferably at least 90%, such as at least 95%, in particular substantially full activity after incubation at 67°C, preferably after incubation at 70°C for 10 min in a 20 mM phosphate buffer, pH 7.0.

10. The polypeptide of claim 1, which is capable of generating a cyclic glucan by an intramolecular transglycosylation reaction, the substrate being an α -glucan.

11. The polypeptide of claim 1, which is derived from the genus *Thermus*, preferably from the species *Thermus rubens*.

12. The polypeptide of claim 11, which is derived from *Thermus rubens* ATCC 31556.

13. The polypeptide of any of claims 1-12, which has at least 20% of the glucanotransferase activity of the polypeptide having the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2.

14. The polypeptide of claim 13, which has at least 30%, such as at least 40%, e.g. at least 50%, preferably at least 60%, such as at least 70%, e.g. at least 80%, at least 90%, or at least 95% of the glucanotransferase activity of the polypeptide having the amino acid sequence shown as amino acids 1 to 501 of SEQ ID NO:2.

15. An isolated nucleic acid sequence comprising a nucleic acid sequence which encodes for the polypeptide defined in any of claims 1-14.

16. An isolated nucleic acid sequence encoding a polypeptide having glucanotransferase activity, selected from the group consisting of:

- (a) a nucleic acid sequence having at least 70% identity with the nucleic acid sequence shown as nucleotides 1 to 1503 of SEQ ID NO:1;
- (b) a nucleic acid sequence which hybridizes under low stringency conditions with
 - (i) a complementary strand of the nucleic acid sequence shown as nucleotides 1 to 1503 of SEQ ID NO:1, or
 - (ii) a subsequence of (i) of at least 100 nucleotides;
- (c) an allelic variant of (a) or (b);
- (d) the glucanotransferase encoding part of the DNA sequence which has been cloned into a plasmid present in *Escherichia coli* DSM 13049, or a variant thereof having at least 70% identity to said DNA sequence; and
- (e) a subsequence of (a), (b), (c), or (d), wherein the subsequence encodes a polypeptide fragment which has glucanotransferase activity;

or an isolated nucleic acid sequence which is the complementary strand of (a), (b), (c), (d) or

(e).

17. The nucleic acid sequence of claim 16, having a nucleic acid sequence which has at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% identity with the nucleic acid sequence shown as nucleotides 1 to 1503 of SEQ ID NO:1;

18. The nucleic acid sequence of claim 16, having a nucleic acid sequence which has at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% identity with the the glucanotransferase encoding part of the DNA sequence which has been cloned into a plasmid present in *Escherichia coli* DSM 13049.

19. A nucleic acid construct comprising the nucleic acid sequence of any of claims 15-18 operably linked to one or more control sequences capable of directing the expression of the polypeptide in a suitable expression host.

20. A recombinant expression vector comprising the nucleic acid construct of claim 19, a promoter, and transcriptional and translational stop signals.

21. A recombinant host cell comprising the nucleic acid construct of claim 19.

22. A method for producing the polypeptide defined in any of claims 1-14, the method comprising:

(a) cultivating a strain from the genus *Thermus*, preferably from the species *Thermus rubens*, such as *Thermus rubens* ATCC 31556 to produce a supernatant comprising the polypeptide; and

(b) recovering the polypeptide.

23. A method for producing a polypeptide as defined in any of claims 1-14, the method comprising:

(a) cultivating a recombinant host cell as defined in claim 21 under conditions

conducive to the production of the polypeptide; and

(b) recovering the polypeptide.

24. Use of the polypeptide as defined in any of claims 1-14 for producing food.

25. Use according to claim 24, wherein the food is selected from the group consisting of Japanese desserts, snacks, wheat products, noodles, gyoza skins, shumai skins, processed seafoods, frozen or refrigerated processed foods, weaning foods, baby foods, pet foods, animal feeds, drinks, sports foods and nutrient supplemental foods.

26. A method for producing food, the method comprising adding the polypeptide as defined in any of claims 1-14 to a food material before or immediately after cooking by heating, whereby the polypeptide acts on the starch in the food material to produce a cyclic glucan.

27. The method according to claim 26, wherein the food is selected from the group consisting of Japanese desserts, snacks, wheat products, noodles, gyoza skins, shumai skins, processed seafoods, frozen or refrigerated processed foods, weaning foods, baby foods, pet foods, animal feeds, drinks, sports foods and nutrient supplemental foods.

28. A cleaning or detergent composition comprising the polypeptide as defined in any of claims 1-14.

29. Use of the polypeptide defined in any of claims 1-14 for removal of starch stains, in particular for removal of amylose stains.

30. A method for removal of starch stains, in particular for removal of amylose stains, from a hard surface or from laundry, the method comprising contacting the amylose stain-containing hard surface or the amylose stain-containing laundry with the polypeptide defined in any of claims 1-14 or with the composition defined in claim 28.